

REMARKS

Claims 10-15 are presented for examination in this Continuation application. Reconsideration is respectfully requested. Claims 1-9 have been cancelled. New claims 11-15 have been added to more completely claim the invention. Claim 10 has been amended to more accurately define the invention. Support for these changes are found at numerous places in the specification including paragraphs [0003], [0010], and the examples.

The parent application included both a system and a method. However, this application has been limited to a method, which more clearly is patentable over the cited prior art.

Claims 10-13 stand rejected under 35 USC 103(a) as being unpatentable over Homan et al., U.S. 5,492,005 in view of the paper "Pollutant Formation and Interaction in the Combustion of Heavy Liquid Fuels" by de Blas. However, there are substantial differences between the amended claimed invention and the cited prior art. These differences are discussed below.

The present invention is a method to determine the tendency of refinery feed stocks to foul the surfaces of refinery equipment. It does not evaluate finished products, products that have already been refined and perhaps additized to meet commercial specifications and do not foul if handled properly.

In a refinery, however, before finished products are generated, care must be taken to control the tendency of several types of molecules in the refinery streams from undergoing undesirable side reactions, e.g., thermally or oxygen (in air) induced oligomerizations/polymerizations that lead to species becoming insoluble and

eventually laying down insoluble deposits. It is these potentially fouling feed stocks that the present invention evaluates.

de Blas is only studying the combustion of heavy distillate fuels (finished products) intended for gas turbine engines with respect to their NO_x and SO_x formation capability during combustion (p. 5). These products are gaseous products of combustion. The Examiner says that de Blas teaches that it is known to test fuel oils for the presence of particulates or deposits. This is correct. The presence of solid particulates or deposits in heavy distillates, especially those derived from a coking process, is well known. Fine coke particles that are carried over from the coker and present in the distillate must be scrupulously filtered or refractionated to remove the solids, otherwise gas turbine engines will fail.

The present invention does not test for the presence of solids or deposits. It tests for the tendency of a refinery feed stream to make or form deposits that will have the potential to come out of solution and foul the surfaces of refinery equipment.

Also, in combustion, unless the combustion is carried out properly in an air rich environment, carbon particulates and soot (not coke) can form; but they do not form in the liquid fuel, they form in the combustor or engine. Proper combustion of fuels produces only carbon oxides, water and nitrogen and sulfur oxides (NO_x and SO_x); all are gases at combustion temperatures.

The fuels de Blas is investigating are indeed by-products of refinery operations. As such, they have been refined into finished commercial products that contain zero particulates and deposits. They will leave no evaporation residue unless the residue is that of a high molecular weight additive (usually present at ppm levels) that has been added into the fuel.

However, when any of these finished products are heated in a pyrolysis test unit, or a carbon residue test unit at 550°C they will all undergo thermal cracking reactions (they begin at ~370°C) and coke-forming reactions that leave behind a solid residue of coke. Such pyrolysis tests are typically used to measure the potential maximum conversion capability of a feed that will undergo thermal treatment in a coker. Fouling via coke residue formation at 550°C is ubiquitous.

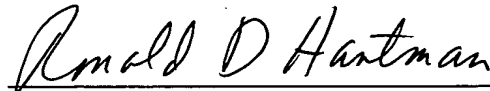
The present invention does not measure the deposit content. In the relatively mild thermal treatment (not pyrolysis or combustion) used in the present invention of 150-300°C (temperatures can go as high as 350°C; just below cracking temperatures) moieties are not cracked off molecules and temperatures are too low to form coke during the relatively short time of our test (1-8 hours). A residue is formed that is usually gummy or tacky that indicates that some extent of oligomerization/polymerization of species/molecules soluble in the feed has taken place. This fouling tendency is measured as a maximum when the test is carried out in air and as a minimum when the test is carried out under nitrogen or other inert atmosphere. ASTM D524-88, cited by the Examiner, is a very severe pyrolysis and is in no way similar to our invention.

The present invention does not test for the presence of deposits. It is determined under what conditions there is a potential/tendency for a refinery stream to form undesirable deposits (not coke) if it is not handled properly or treated properly in the refinery. For example, if exposure to air cannot be avoided, then the impact and effectiveness of additives that prevent reaction of organic molecules with air is assessed by this invention. There is no comparable test available in the industry.

Applicants believe that the claims now present in this application to be patentable and that this application is in condition for allowance, and such favorable action is respectfully requested. If any questions or issues remain, the

resolution of which the Examiner feels would be advanced by a conference; he is invited to contact Applicants' attorney at the telephone number noted below.

Respectfully submitted,



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☐ Pursuant to 37 CFR 1.34(a)

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